



November 2016

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) TREATMENT

For

CONTECH Engineered Solutions Media Filtration System (MFS)

Ecology's Decision:

1. Based on the Contech's application submissions and recommendations by the Technical Review Committee (TRC), Ecology hereby issues a General Use Level Designation (GULD) for the Media Filtration System (MFS):

- **As a basic stormwater treatment practice for total suspended solids (TSS) removal,**
- **Using perlite media, with the size distribution described below,**
- **Sized for a range of cartridge sizes from 12-inches to 22-inches tall assuming a constant unit flow rate of 1-gpm for every 2.44 inches of height. This results in an allowable operating rate of 4.9 gpm for the 12-inch tall cartridge and 9.0 gpm for the 22-inch tall cartridge (except as stated in Condition #1, below), and**
- **Internal bypassing needs to be consistent with the design guidelines in Contech's current product design manual. Off-line configurations allow for easy identification of maintenance needs.**

2. Ecology approved MFS systems containing perlite for treatment at 9.0 GPM for 22-inch tall cartridges and 4.9 gpm for 12-inch tall cartridges per 18-inch diameter cartridge. Designers shall calculate the water quality design flow rates using the following procedures:

- **Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.**
- **Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the**

- Stormwater Management Manual for Eastern Washington (SWMM EW) or local manual.**
- **Entire State:** For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
- 3. This designation has no expiration date, but it may be amended or revoked by Ecology, and is subject to the conditions specified below.**

Ecology's Conditions of Use:

The MFS shall comply with these conditions:

- 1. Design, assemble, install, operate, and maintain the MFS system in accordance with applicable Contech Engineered Solutions manuals, documents and the Ecology Decision.**
- 2. Install the MFS in such a manner that you bypass flows exceeding 9.0 gpm/cartridge or you will not re-suspend previously captured sediments. Design MFS in accordance with the performance goals in Ecology's most recent Stormwater Manual. The design, pretreatment, land use application, and maintenance criteria must follow the MFS design requirements.**
- 3. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.**
 - **Typically, CONTECH designs the MFS for a target filter media replacement interval of 12 months. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.**
 - **Testing results provided to Ecology for the Basic GULD approval indicate:**
 - **At one site, filter cartridges were still in operation after approximately ten months of monitoring and 35.6 inches of rainfall, with no apparent decrease in performance.**
 - **At a second site, Contech ceased monitoring before the hydraulic capacity decreased. Contech replaced cartridges after approximately four months of monitoring and 20.4 inches of rainfall to conduct a loading mass balance of the system. The loading mass balance of the entire system resulted in 51 lbs of sediment per cartridge.**
 - **Blockage or occlusion of the media did not occur as evidenced by lack of a decrease in TSS treatment or by elevated vault water levels during monitored storm events at either site. Contech analyzed spent cartridges and determined the cartridges were at full capacity for the**

theoretical maximum allowable amount of solids capture.

- **The above particular maintenance intervals do not necessarily determine the overall maintenance frequency for all Media Filtration Systems.**
 - **Owners/operators must inspect the MFS for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.**
 - **Conduct inspections by qualified personnel, follow manufacturer's guidelines, and you must use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.**
 - **When inspections are performed, the following findings typically serve as maintenance triggers:**
 - **Accumulated vault sediment depths exceed an average of 12 inches, or**
 - **Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or**
 - **If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.**
 - **Bypass during storms smaller than the design storm.**
- 4. Contech shall maintain readily available those reports listed under "Application Documents" as public, as well as the documentation submitted with its previous conditional use designation application. Contech shall make this information available upon request, at no cost and in a timely manner.**
- 5. The perlite media used shall conform with the following specifications:**
- The size of the media ranges from 0.125 to 0.375 inches. The dry bulk density ranges from 4.5 to 6.5 lbs per cubic foot. The following table shows a typical particle size distribution of the perlite media**

Sieve Analysis of the perlite media:

US Sieve No.	Sieve Opening (µm)	% Retained by Volume
4	4760	35-50
8	2360	75-99
16	1180	98-100
30	600	99-100
50	300	99-100
100	150	99-100

Each 22 inch cartridge contains a total of approximately 3.14 cubic feet of media.

Applicant: Contech Engineered Solutions

Applicant's Address: Contech Engineered Solutions
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Portland, OR 97220

Application Documents:

“Application to Washington Department of Ecology Water Control Program for General Use Level Designation of Media Filtration System – Technical Evaluation Engineering Report”, Contech Engineered Solutions, July 2006. It includes the following public report:

- (Public) “Evaluation of the Media Filtration System: Data Validation Report and Summary of the Technical Evaluation Engineering Report (TEER)”, Water Resources Management, June 2006.
- Ecology’s technology assessment protocol requires the applicant to hire an independent consultant to complete the following work:
 1. Complete the data validation report.
 2. Prepare a TEER summary, including a testing summary and conclusions compared with the supplier’s performance claims.
 3. Provide a recommendation of the appropriate technology use level.
 4. Ecology recommends you post relevant information on Ecology’s website.
 5. Provide additional testing recommendations, if needed.”
- This report, authored by Roger B. James, P.E., Water Resources Management, satisfies the Ecology requirement.

Above-listed document noted as “public” is available by contacting Contech.

Applicant's Use Level Request:

General Use Level Designation for Basic Treatment for the MFS using perlite at 9.0 GPM/filter (18-in diameter, 22-in tall) in accordance with Ecology's most recent stormwater management manual.

Applicant's Performance Claim:

The combined data from the two field sites reported in this TEER (Silverton Highway, Hillsboro, OR and Lolo Pass, Zigzag, OR) indicate that the performance of a MFS configured for inline bypass with perlite media and a 9.0 GPM filtration rate per 22-inch tall cartridge meets Ecology performance goals for Basic Treatment.

Technical Review Committee Recommendations:

The TRC, based on the weight of the evidence and using its best professional judgment, finds that:

- The MFS, using perlite media and operating at no more than 9.0 GPM per 22-inch tall cartridge is expected to provide effective stormwater treatment achieving Ecology's basic treatment removal goals, as demonstrated by field and laboratory testing performed in accordance with the protocol; and
- Ecology deems the MFS satisfactory with respect to factors other than treatment performance.

Findings of Fact:

- Influent TSS concentrations and particle size distributions were generally within the range of "typical" concentrations for western Washington (silt to silt loam).
- Contech sampled storm events at two monitoring sites for storms from December 2005 to April 2006, and deemed twenty nine (29) as "qualified" and were therefore included in the data evaluation. Both sites were located on roadways.
- Statistical analysis of these 29 storm events verifies the data set's adequacy.
- For the ten (10) qualifying events with influent TSS concentrations greater than 100 mg/L but less than 300 mg/L, the average influent concentration, average effluent concentration, and average pollutant reduction were 151.70 mg/L, 24.81 mg/L, and 83.6%, respectively.
- For the nineteen (19) qualifying events with influent TSS concentrations less than 100 mg/L, the average influent concentration, average effluent concentration, and average pollutant reduction were 61.42 mg/L, 19.09 mg/L, and 68.9%, respectively.
- The float control valve operated as designed according to the inflow, outflow and water elevation measurements in the vault.
- Laboratory testing using U.S. Sil-Co-Sil 106 showed removal rates around 85% for flowrates 10 GPM or below, and between 72% and 81% for flowrates at or above 15 GPM.

- At the Silverton site, flows ranged between 19.6% and 304.5% of the water quality design flowrate, and averaged 138% of the water quality design flowrate.
- At the Lolo Pass site, flows ranged between 7.8% and 150.9% of the water quality design flowrate, and averaged 57.4% of the water quality design flowrate.
- Analyzing the individual storm events at Lolo Pass, Zigzag (20 storms) and Silverton Highway, Hillsboro site (11 storms), the average removal of total chromium ranged from 62.1% to 62.9%, the average removal of total zinc ranged from 51.9% to 63.5%, the average removal of total copper ranged from 57.2% to 61.3%, and the average removal of total lead ranged from 69.4% to 70.9%. These removals do not qualify for an enhanced treatment designation.
- Analyzing the individual storm events at Lolo Pass, Zigzag (17 storms) and Silverton Highway, Hillsboro site (11 storms) the removal of total phosphorus was 67%. These removals do not qualify for phosphorus treatment designations.
- The Contech application included a satisfactory discussion for the “Factors other than Treatment Performance” section.

Note: Ecology’s 80% TSS removal goal applies to 100 mg/l and greater influent TSS. Below 100 mg/L influent TSS, the goal is 20 mg/L effluent TSS.

Technology Description and System Operation:

A weir diverts stormwater runoff entering the system and water flows to the portion of the vault beneath the cartridge where the system settles and captures larger solids. The system operates by filtering the stormwater through media filled cartridges. The system is designed to allow approximately 3 GPM or less to flow through each cartridge while the water level is rising in the vault (slide gate is in the closed position).

Filtered water enters a perforated drain tube located in the center of the cartridge and flows to the collector manifold through a flexible pipe. Contech plumbed the manifold to a float controlled slide gate that sets the overall operational control of the Media Filtration System to achieve a balance between flow and driving head level. Contech designed the float to fully open the slide gate as the water level reaches the top of the cartridges. The float control valve ensures that the system develops a uniform vertical pressure distribution from the bottom to the top of each cartridge, which ensures even hydraulic loading and maximum exposure of the perlite media within each cartridge filter at the same time and hydraulic loading rate.

After the storm event has ended, the remaining water is slowly released at less than or equal to 3GPM through each cartridge and the slide gate until the vault is drained to the outlet pipe's invert level. This less than or equal to 3 GPM/cartridge drain down is an engineered process that has been designed into the slide gate and is referred as the "leakage". This operation of the slide gate assures that the system doesn't expose media to artificial shocking flows or abrupt hammering hydraulic forces that can destabilize and/or induce channelization through the media. When stormwater runoff flows recede, the float controlled slide gate will close until the next triggering runoff event.

Contech positions cartridges 21 inches above the vault floor providing an underbay (forebay) volume for settling larger, heavier sediments below the cartridges preventing occlusion of the media resulting from sediment buildup. When the system is operating at a 9GPM/cartridge design loading rate, the maximum upflow velocity in the vault is approximately 2 mm/sec. At this upflow velocity, particles in the 45 to 50 micron size range with a specific gravity of 2.65 may settle in the area beneath the cartridges removing the majority of the mass of suspended solids found in stormwater runoff. This presettling design feature makes for long filter bed run times, reduces the frequency of maintenance, and negates the need to thoroughly clean the entire vault structure each time you exchange or recharge media cartridges.

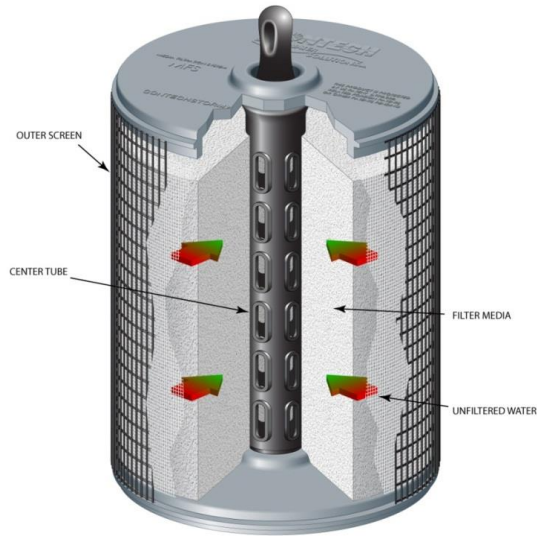


Figure 1 - Image of a MFS cartridge

MFS Configurations:

Contech offers the MFS in four basic configurations: precast manhole, trench catchbasin, and vault or cast-in-place vault form. The precast models use pre-manufactured units to ease the design and installation process. Contech can customize cast-in-place units for larger flows and may be either uncovered or covered underground units.

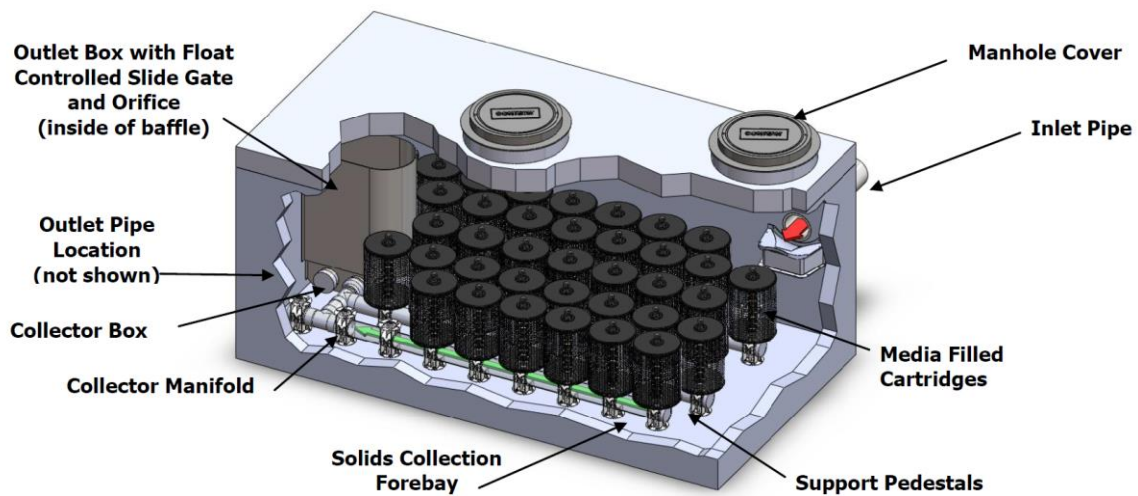


Figure 2 - The Precast Media Filtration System

Recommended Research and Development:

Ecology encourages Contech to pursue continuous improvements to the MFS. To that end, Ecology recommends the following actions:

- Conduct a hydraulic analysis of units that require complete drawdown of water between events. Conduct a hydraulic analysis to discover the percent of untreated water that is lost during drawdown and operation of these units.
- Continue work on developing best operation and maintenance practices. Contech is encouraged to update Ecology and the TRC of their operation and maintenance experiences.
- As you gain experience on operation and maintenance, Contech is encouraged to update their O&M manual to reflect learned knowledge.

Contact Information:

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Revision History

Date	Revision
November 2006	GULD for Basic Treatment
December 2011	Updated information on cartridge heights and flows
February 2013	Maintenance requirements updated, design storm discussion revised
November 2016	Revised Contech contact information